



National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material[®] 3001

Toluene in Methanol

(Nominal Mass Fraction – 0.01 g/g)

This Standard Reference Material (SRM) is a gravimetrically prepared single compound solution (toluene) in methanol intended primarily for the calibration of instrumentation and validation of methods for volatile organic compound (VOC) determinations. Because of its miscibility with water, this SRM can also be used to fortify aqueous samples with known amounts of the VOC. One unit of SRM 3001 consists of two 5 mL sealed borosilicate glass ampoules with approximately 2.5 mL of this SRM mixture in each.

Certified Value: The certified concentration value [1,2] for toluene, reported as a mass fraction, is given below.

Toluene (mass fraction): 0.009 73 g/g \pm 0.000 06 g/g

The certified value is the unweighted average of the concentration determined by gravimetric and chromatographic methods. The expanded uncertainty, at a 95 % level of confidence, is calculated as $U = ku_c$, where u_c is a combined standard uncertainty calculated according to the ISO and NIST Guides [3] and $k = 2$ is the coverage factor. The quantity u_c represents, at the level of one standard deviation, the combined effects of the uncertainty due to purity assessment and an allowance for differences between the concentration determined by gravimetric preparation and chromatographic measurements on the certified value.

Reference Value: A NIST reference value is a non-certified value that are the best estimates of the true values; however, the values do not meet NIST criteria for certification and are provided with associated uncertainties that may reflect only measurement precision and may not include all sources of uncertainty. A reference value [1] for density is provided for the calculation of volume to assist in the transfer of material during gravimetric dilutions of the SRM.

Density of the SRM Solution at 22 °C: 0.790 42 g/mL \pm 0.000 01 g/mL

Expiration of Certification: The certification of this SRM is valid, within the measurement uncertainties specified, until **31 January 2011**, provided the SRM is handled and stored in accordance with the instructions given in this certificate (see “Instructions for Use”). This certification is nullified if the SRM is contaminated or otherwise modified.

Maintenance of SRM Certification: NIST will monitor this SRM over the period of its certification. If substantive changes occur that affect the certification before the expiration of this certificate, NIST will notify the purchaser. Registration (see attached sheet) will facilitate notification.

The overall coordination and direction of the technical work required for this SRM certification were performed by F.R. Guenther of the NIST Analytical Chemistry Division.

The analytical measurements leading to the certification of this SRM were performed by T.L. Green, F.R. Guenther, and C.R. Mack of the NIST Analytical Chemistry Division.

Statistical consultation was provided by S.D. Leigh of the NIST Statistical Engineering Division.

Stephen A Wise, Chief
Analytical Chemistry Division

Gaithersburg, MD 20899
Certificate Issue Date: 13 July 2005
See Certificate Revision History on Last Page

Robert L. Watters, Jr., Chief
Measurement Services Division

The support aspects involved in the issuance of this SRM were coordinated through the NIST Standard Reference Materials Program by B.S. McDonald of the NIST Measurement Services Division.

SRM Preparation: This SRM was prepared by NIST using precise gravimetric mass determinations. Chemicals used in the preparation were received from commercial sources and were assessed for purity at NIST using differential scanning calorimetry (DSC), gas chromatography with flame ionization detection (GC/FID), and gas chromatography with mass selective detection (GC/MSD).

Toluene Concentration Value Assignment: The certified value for toluene is based on the gravimetric preparation of the SRM and analysis by GC/FID of randomly selected ampoules from the lot. The analytical method was calibrated using four calibration standards independently prepared by gravimetry.

INSTRUCTIONS FOR USE

Storage: Sealed ampoules should be stored in the dark at temperatures between 10 °C and 30 °C.

Opening of Ampoule: Open ampoules carefully to prevent contamination and injury. The ampoules are pre-scored and should **NOT** be opened using a file. It is recommended that aliquots be withdrawn at temperatures between 20 °C and 25 °C. Each ampouled solution must be opened in a clean, dry environment and processed without delay. Each ampouled solution of the SRM is intended for use immediately after opening and may **NOT** be reused, even if resealed.

Preparation of Working Standard Solutions by Mass: Great care must be used in handling this SRM. Dilution of this SRM should be made gravimetrically (weighed) and **NOT** by volumetric means (volume may be calculated for transfer purposes only). It is recommended that the SRM material be transferred in a gas-tight syringe to a septum sealed container containing the diluent. It is critical that the SRM be injected slowly beneath the surface of the diluent. The syringe should be weighed before injecting the material and weighed again after solution transfer. This allows subtraction of the mass of the syringe and any SRM material that remains in the syringe. The amount of toluene added to the diluent can then be determined from the mass added and the certified value.

REFERENCES

- [1] May, W.E.; Parris, R.M.; Beck II, C.M.; Fassett, J.D.; Greenberg, R.R.; Guenther, F.R.; Kramer, G.W.; Wise, S.A.; Gills, T.E.; Colbert, J.C.; Gettings, R.J.; MacDonald, B.S.; *Definition of Terms and Modes Used at NIST for Value-Assessment of Reference Materials for Chemical Measurements*, NIST Special Publication 260-136; U.S. Government Printing Office: Washington, DC (2000).
- [2] Taylor, B.N.; *Guide for the Use of the International System of Units (SI)*; NIST Special Publication 811; U.S. Government Printing Office: Washington, DC (1995).
- [3] ISO; *Guide to the Expression of Uncertainty in Measurement*, ISBN 92-67-10188-9, 1st ed., International Organization for Standardization: Geneva, Switzerland (1993); see also Taylor, B.N.; Kuyatt, C.E.; *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*; NIST Technical Note 1297, U.S. Government Printing Office: Washington, DC (1994); available at <http://physics.nist.gov/Pubs/>.

Certificate Revision History: 13 July 2005 (This technical revision reports an extension in the certificated period); 15 June 2001 (Original certificate date).
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Users of this SRM should ensure that the certificate in their possession is current. This can be accomplished by contacting the SRM Program at: telephone (301) 975-6776; fax (301) 926-4751; e-mail srminfo@nist.gov; or via the Internet at <http://www.nist.gov/srm>.